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THE EFFECT OF GUIDED INQUIRY-BASED STRATEGY ON STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS.

by

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Abstract

The study investigated the Guided Inquiry-Based Strategy on Students' Academic Achievement in Mathematics. Two hypotheses were formulated and tested at 0.05 alpha level. The study adopted pretest, post-test (control group), quasi-experimental design. The sample consisted of one hundred and eighty (180) Senior Secondary School one (S.S.S.I) students drawn from six randomly selected senior secondary schools in Epe Local Government Area of Lagos State. Intact classes were used. Mathematics Achievement Test (MAT) and lesson note on the concept of Geometry were used as instruments to generate data for six weeks of treatment. T-test statistics was used to analyze the data collected. The results obtained indicated that students instructed with Guided Inquiry-Based Strategy performed better than those taught using conventional strategy. There is no significance difference in the performance between male and female students in experimental group. Based on these findings, it was recommended that Guided Inquiry-Based Strategy should be used to specifically teach Geometry in Nigerian Senior Secondary Schools.

Keywords: Mathematics, Inquiry, Guided Inquiry-Based Strategy, Geometry.

Introduction

Education is considered as the most powerful tool for all round development of human beings. The need to acquire knowledge in Mathematics in the world ever has become very obvious. This is because it is relevant to everyday living and in various disciplines. Popoola (2002) states that right from the pre-historic days of the early human societies to the present "Intec" age, Mathematics has played a fundamental role in the economic development of many countries of the world. Mathematics is a powerful tool for instilling lifelong skills which can make an individual self-reliant. Ugwu, Ofuebe and Etubon (2011) posited that Mathematics is a pivot around which many other subjects revolve. Mathematics involves activities such as formation of concepts, abstraction, generalization, theorem building and problem solving which is basic to Mathematics activities (Sulaiman & Abdullahi; 2015). Of all the sciences, Mathematics serve as a rudiment in which a child is taught the spirit of inquiry and reasoning.

Mathematics helps man to give exact interpretation to his ideas and conclusions. It is the numerical and calculative part of man's life and knowledge. It plays a predominant role in our everyday life and it has become an indispensable factor for the progress of our present day world. The process of inquiry begins with construction, gathering information and data through applying human senses. According to (Ferguson, 2010) the inquiry based teaching approach has a positive effect on the mathematics achievement of students. In inquiry based learning, the teacher acts as the facilitator of the students learning rather than the supplier of information. As well as having a splendid comprehension of the content the teacher needs to plan their learning units carefully. This planning will involve the teacher devising a topic based on the curriculum for the students to determine their own questions. It also involves exploration type activities to activate prior knowledge and also engage the students. Guided

Inquiry-Based Strategy involves change in the organization of the manner in which the content is taught. It is an approach to teaching and learning that places students' questions, ideas and observation at the center of the learning experience. Guided Inquiry-Based Strategy draws on constructivist ideas of learning in which learners construct new ideas or form concept based upon their experience or prior knowledge (Kanselaar, 2002). According to Scardamailia (2002), instructors play an active role throughout the process by establishing a culture where ideas are challenged, tested and viewed regardedly, moving learners from a wondering position to enacted understanding and questioning further situation. He further pointed that students need specific skills to be actively involved in the inquiry process, these are:

i. Identify causal relationship
ii. Describe the reasoning process
iii. Use data as evidence and
iv. Evaluate

In Guided Inquiry-Based Strategy, teachers have a responsibility of finding creative ways to introduce students to ideas and to subject matter that is of interest to them. In conventional strategy of teaching, the teacher talk and the student listen but in Guided Inquiry-Based Strategy, new roles are implied for the students and the facilitator. The move to Guided Inquiry-Based Strategy requires a move from didactic teaching practices towards practice that engage students in observation, experimentation, planning and culminating in the construction of knowledge and understanding of the discipline. According to Wang & Posey (2011) inquiry based learning challenges, stimulates students to learn new concepts and they gain confidence in their problem solving ability. The fundamental concept in Guided Inquiry-Based Strategy regards to a process of personal discovery by the learners. In Guided Inquiry-Based Strategy, the learners' inquirers are guided to generate relevant questions and to come up with appropriate answers through critical thinking. Guided Inquiry-Based Strategy teaches the learners to respect one's own interest and interest of others (Donham, 2001).

Statement of the Problem

It is however worrisome to observe that many students still get low grades in Mathematics in both internal and those conducted by external bodies like West Africa Examination Council (WAEC) and National Examination Council (NECO). Agwagah (2008) observed that the international communities are aware of student's poor performance in Mathematics in Nigeria.

Understanding of any topic in mathematics depends on the personal interpretation or construction that student make out of it. Teachers are the implementer of mathematics curriculum in schools. Therefore, it is necessary for all Mathematics teachers to employ every possible strategy to ensure that students are well grounded in the knowledge of Mathematics. Many factors had earlier been stated to be cause of student poor performance. Amongst which is the teaching method adopted by the teacher, yet not remarkable improvement has been noticed in it. This study focused on the effect of Guided Inquiry-Based Strategy (GIBS) on students' achievement in Mathematics.

Purpose of the study

The study is specifically set out to:

1. Measure students' performance taught using Guided Inquiry-Based Strategy and those taught using conventional learning.

2. Determine which method is better between Guided Inquiry-Based Strategy and Conventional method of learning.
3. Make recommendations on how to make use of the two aforementioned methods effectively.
4. Generate further literature on the methods highlighted.

Hypotheses

The following null hypotheses were formulated:

i. There is no significant difference between the achievement of students taught mathematics using Guided Inquiry-Based Strategy and those taught with conventional learning in Mathematics.

ii. There is no significant difference in the achievement of male and female students taught with Guided Inquiry-Based Strategy towards Mathematics.

Methodology

The study utilized the pre-test, post-test control quasi-experimental design involving two groups tagged "Experimental" and "Control". The target population consisted of the entire Senior Secondary School Students I (S.S.S. I) in Epe Local Government Area of Lagos state. Six schools were randomly selected. The schools were far from each other. Three of the schools were used as experimental group while the other three were used as control group. Intact classes were used in all the schools. The study was delimited to six randomly selected secondary schools in Epe Local Government Area of Lagos State. The study is also delimited to all SSS 1 students in the six (6) schools and each contains 30 students in a classroom (i.e 30 x 6 = 180). All the students in the six schools are 180. Mathematics Achievement Test (MAT) was used. This consisted of 40 multiple-choice items covering the topics in Geometry as a theme in the Senior Secondary School Curriculum. The topics are area and perimeter of two dimensional shapes, area and volume of three dimensional shapes, length of arcs, area of a sector, area and perimeter of segment, angles and lines. For the control group, topics were taught through presentation of information and explanations but for the experimental group the same information and explanation were made through exploring new ideas, personal discoveries, interaction with objects, real life activities and situation to generate relevant questions and come up with appropriate answers through critical thinking. The duration of the study was six weeks. Students were first administered a pre-test before exposure to the teaching. A post-test was administered immediately after teaching. The same instrument was administered in the pre-test and post-test. The instrument was face and content validated by two mathematics experts and a lecturer in the measurement and evaluation department. The instrument has a reliability coefficient of 0.87 when subjected to Kuder-Richardson's formula 20, because the 40 items are with intermediate level of difficulty. The data collected were analyzed using Mean, Standard Deviation and T-test. All hypotheses were tested at 0.05 of significance level.

Results and Discussion

H_0:1 There is no significant difference between the cognitive achievement of students taught mathematics using Guided Inquiry-Based Learning Strategy and those taught with conventional learning in mathematics.

Cognitive Achievement	N	$\bar{X}$	Std. Dev.	T-Cal	Df	T-table	Remarks
Guided Inquiry-Based Learning Strategy	90	39.15	9.42	2.06	178	1.96	Rejected
Conventional Learning	90	37.26	10.81				

*at .05 level of significant

Table 1 shows that students instructed with Guided Inquiry-Based Strategy ($\bar{X}$ = 39.15) performed better than those taught using Conventional Learning Strategy ($\bar{X}$ =37.26) with T-calculated value of 2.06 greater than the table value of 1.96 at 0.05 level of significant at 178 degree of freedom. The null hypothesis is thus rejected implying that there is significant difference in the cognitive achievement of students taught with Guided Inquiry-Based Strategy and those taught with Conventional Strategy in Mathematics.

H_0:2 There is no significant difference in the cognitive achievement of male and female students taught with Guided Inquiry-Based Learning Strategy towards mathematics.

Gender	N	$\bar{X}$	Std. Dev.	T-value	Df	T-table	Remarks
Male	35	31.26	6.94	1.78	178	1.96	Accepted
Female	45	29.57	9.75				

*at .05 level of significant

Table 2 shows that gender has nothing to do with the cognitive achievement of male and female students taught with Guided Inquiry-Based Learning Strategy. The table revealed that T-calculated value of 1.78 is less than the t-tabulated value of 1.96 at 0.05 level of significance at 178 degree of freedom. The null hypothesis is thus not rejected implying that there is no significant difference in the cognitive achievement of male and female students taught with Guided Inquiry-Based Learning Strategy in Mathematics.

Discussion of Results

Hypothesis I stated that there is no significant difference in the cognitive achievement of students taught with Guided Inquiry-Based Strategy and those taught with Conventional Strategy in Mathematics. The hypothesis was rejected after being subjected to t-test statistical analysis. This implies there is significant difference in the cognitive achievement of students taught with Guided Inquiry-Based Strategy and those taught with conventional Strategy in Mathematics. This is because students taught with Guided Inquiry-Based Learning Strategy found learning to be interesting and understandable, unlike those taught with conventional method, who found learning sometimes to be boring and difficult. The results of this study are consistent with the earlier studies by Riordan & Noyce (2001) which showed that students in schools using guided inquiry-based strategy as their primary mathematics Curriculum performed significantly better than student taught using the conventional strategy. In addition, the results of this research confirms the observation made by Wang & Posey (2011) that the traditional approaches of mathematics instruction do not seem to help students achieve the intended learning outcomes in mathematics curriculum.

Hypothesis II was accepted after being subjected to T-Test statistical analysis. This implies that there is no significant difference in the cognitive achievement of male and female

students taught Guided Inquiry-Based Learning Strategy towards Mathematics. The finding of the study reveals that both male and female students can perform better in any subject. The finding of the study corroborates with that Popoola, (2002) who reported that cognitive achievement in science is not gender sensitive.

Conclusion and Recommendation

The conventional strategy using in teaching mathematics does not encourage creativity and critical thinking in mathematics class. In fact, its brings low conceptual understanding in geometry. The guided inquiry-based learning strategy is a compelling alternative to the more conventional classroom strategy utilized in the past. The learners must inquire directly to gain a deep comprehension of the features in order to grasp the concept. It is recommended that in-service teachers should try to adopt guided inquiry-based learning strategy in their teaching. The students would benefit greatly as it allows for reflection of ideas in order the build knowledge, comprehension and interpretation of concepts in Mathematics.

References

Agwagha, U.N.V. (2009). Laboratory Approach to Mathematics Instruction: A situation report to Nigerian Secondary schools in 1990s. *Journal of Liberial Studies*, 5(2), 116-124.

Donham, J (2001) The importance of model. Dlm Donham, J.Bishop, C., Kulthau, C. & Oberg, D. (eds). Inquiry learning: Lessons from library power. Worthington OH: Linworth.

Ferguson, K. (2010). Inquiry Based Mathematics Instruction Versus Traditional Mathematics Instruction: The Effect on Student Understanding and Comprehension in an Eighth Grade Pre-Algebra Classroom. Cedarville: Cedarville University.

Kanselaar, G. (2002), Constructivism and Socio-Constructivism. [Online] Retrieved 10 April 2012 from: http://edu.fss.uu.nl/mederkers/gk/file/Constructivismgk.pdf

Popoola, A.A. (2002) Effect of Heuristic Problem – Solving and programmed Instruction al Strategies on Senior Secondary School students' learning outcome in Mathematics in Ekiti state, Nigeria Unpublished Ph.D. Thesis, university of Ibadan, Ibadan.

Riordan, J. E., & Noyce, P. E. (2001). The impact of two standards based mathematics curricula on student achievement in Massachusetts. *Journal for Research in Mathematics Education*, 32,368-398.

Scardamalia, M. (2002), Collective Cognitive Responsibility for the Advancement of knowledge Society. 67-98. Chicago, IL:Open Court.

Suleiman, B & Abdullahi, M. (2015), Mathematics Education, a Vehicle for Quality Entrepreneur Skills and Competences for Transforming Nigeria. Abacus: *Journal of Mathematics Associations of Nigeria*. 40(1), 43-50.

Ugwu, A.N., Ofuebe, J.I., & Etubon, R.U. (2011), Status of Science and Technology Curricula towards National Education Reforms. STAN 52nd Annual Conference Proceedings. (48-53) WAEC (2012) Chief Examiners Report. General Certificate of Education/School Certificate O' Level Papers. WAEC. Lagos

Wang, H., & Posey, L. (2011). An inquiry-based linear algebra class,online submission. U.S China Education Review, 489-494.